US005478658A

United States Patent [19]

Dodabalapur et al.

[11] **Patent Number: 5,478,658**

[45] **Date of Patent: Dec. 26, 1995**

[54] **ARTICLE COMPRISING A MICROCAVITY LIGHT SOURCE**

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[21] Appl. No.: **246,439**

[22] Filed: **May 20, 1994**

[51] **Int. Cl.**[6] **H05B 33/12**; H01S 3/08

[52] **U.S. Cl.** **428/690**; 428/917; 313/504; 372/92; 372/45; 372/39; 372/7; 372/69; 372/41; 372/6; 372/2; 372/44; 385/47; 385/131; 359/838

[58] **Field of Search** 428/690, 691, 428/917; 313/504; 372/92, 45, 39, 7, 69, 41, 6, 2, 44; 385/47, 131; 359/838

[56] **References Cited**

U.S. PATENT DOCUMENTS

5,306,385	4/1994	Cho et al.	156/610
5,363,398	11/1994	Glass et al.	372/92
5,369,657	11/1994	Cho et al.	372/39

OTHER PUBLICATIONS

"Physics and Device Applications of Optical Microcavities", by H. Yokoyama, *Science,* vol. 256, Apr. 3, 1992, pp. 66–70.

"Optical Processes in Microcavities", by Y. Yamamoto et al., *Physics Today,* Jun. 1993, pp. 66–73.

"Microcavity Effects in Organic Semiconductors", by A. Dodabalapur et al., *Applied Physics Letters,* vol. 64(19), May 9, 1994, pp. 2486–2488.

"Developers Continue to Refine Blue LED Technologies for Display Use", by K. Murata, *Display Devices,* 1992, pp. 47–50.

"White Light–Emitting Organic Electroluminescent Devices Using the Poly(N–vinylcarbaxole) Emitter Layer Doped With Three Fluorescent Dyes", by J. Kido et al., *Applied Physics Letters,* vol. 64(7), Feb. 14, 1994, pp. 814–817.

"Electroluminescence from Single Layer Molecularly Doped Polymer Films", by G. E. Johnson et al., *SPIE,* vol. 1910, pp. 6–14.

"Electroluminescence of Doped Organic Thin Films", by C. W. Tang et al., *Journal of Applied Physics,* vol. 65, No. 9, May 1, 1989, pp. 3610.

"Spontaneous Emission From Planar Microstructures", By D. G. Deppe et al., *Journal of Modern Optics,* vol. 41, No. 2, 1994, p. 325.

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[57] **ABSTRACT**

Optical microcavities are potentially useful as light emitters for, e.g., flat panel displays. Such microcavities comprise a layer structure, including two spaced apart reflectors that define the cavity, with a layer of organic (electroluminescent) material disposed between the reflectors. We have discovered that a microcavity can simultaneously emit radiation of two or more predetermined colors such that the emission has a desired apparent color, exemplarily white. Emission of two or more colors requires that the effective optical length of the cavity is selected such that the cavity is a multimode cavity, with the wavelengths of two or more of the standing wave modes that are supported by the cavity lying within the emission region of the electroluminescence spectrum of the active material.

21 Claims, 3 Drawing Sheets